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ABSTRACT

Teachers must have accurate, up-to-date knowledge about biodiversity in order to help prepare world citizens to cope with the problems of decreasing variability on our planet. The objectives of this study were to: (1) develop a reliable, valid test of teacher knowledge about biodiversity; (2) administer this test to K-12 teachers to determine their current knowledge about biodiversity; and (3) determine how selected teacher demographic variables relate to test scores. The theoretical frzmework for the development of this test was based on the classification of knowledge about biodiversity into three levels of variability: (1) ecosystem level; (2) species level; and (3) genetic/molecular level. Each of 44 questions developed for a true/false biodiversity test represented knowledge about one of these three levels. Based on evaluation of the test by ecologists and logical analysis, the test was found to be valid. This test was administered to 64 K-12 teachers enrolled in an environmental education course. The average score on the test was about 50%. Teacher knowledge about biodiversity did not differ much for each of the three biodiversity levels. The number of environmental/environmental education courses taken by teachers was positively related to teacher knowledge about biodiversity. Appendix contains a copy of the test. Contains 12 references. (Author/PVD)

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ED 406 147

The Development of a Test of Teacher Knowledge About Biodiversity

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Abstract

Teachers need to have accurate and up-to-date knowledge about biodiversity in order to help prepare world citizens to cope with the problem of decreasing variability on our planet. Do K-12 teachers have an adequate understanding of biodiversity? It is this question that provided the focus for this study. The objectives of this study were to: 1) develop a reliable and valid test of teacher knowledge about biodiversity; 2) administer this test to K-12 teachers to determine their current knowledge about biodiversity; and 3) determine how selected teacher demographic variables relate to test scores. The theoretical framework for the development of this test was based on the work of Otto T. Solbrig who classified knowledge about biodiversity into three levels of variability, namely: the ecosystem level, the species level, and the genetic/molecular level. These three levels of biodiversity are important for successful adaptation to a changing environment. A forty-four(44) question true/false biodiversity test was developed for teachers by John Norman and Suzzane Stevens . Each of the items represented knowledge about one of the three levels of biodiversity described by Solbrig. The validity of the test was further studied by asking university ecologists to indicate whether the test questions/answers were accurate and to evaluate the placement of the questions into the various biodiversity level categories. Based on the responses of the ecologists and th logical analysis, the test was found to be valid. This Norman-Stevens Biodiversity Test was subsequently administered to sixty-four(64) K-12 teachers enrolled in an environmental education course. An internal consistency reliability for the entire test was calculated and found to be good (r=.83). Teachers demonstrated a lack of knowledge about important concepts about biodiversity. The average score on the test (n=64) was about 50%. In fact, twenty questions (of 40 questions) were answered correctly by less than 75% of the teachers. Teacher knowledge about biodiversity did not differ much for each of the three biodiversity levels. Certain demographic variables were examined by analysis of variance to see how they related to teacher responses on the Biodiversity Test. The following teacher demographic variables were examined: age of teachers, years of teaching experience, grade level taught, certification major, preservice vs. inservice teachers, number of university environmental (or ecology or environmental education courses taken), number of environmental organizations teachers belong, and type of community where teachers work. Significant differences ($p<.05$) were only found for the demographic variable of number of university environmental courses taken. The greater the number of such courses taken, the greater the knowledge of biodiversity as measured by this test. The following conclusions were made in this study: 1) The Norman-Stevens Biodiversity Test is a valid and reliable test for measuring teacher knowledge about biodiversity; 2) Teacher knowledge about biodiversity is fairly poor for all three levels of biodiversity; 3) The number of environmental/environmental education courses taken by teachers has a positive relationship to their knowledge about biodiversity.

Introduction

The Earth is the only planet in the solar system in which *Homo sapiens* has inherited, manipulated and exploited both its organic and inorganic diversity. People burn fossil fuel and biomass to get energy, destroy wet lands to make shelter, and release toxic substances into the environment. All these activities directly or indirectly affect the habitat of most organisms. The destruction of habitat is the major factor causing the extinction of living things.

The rate of extinction of living species has become a global environmental problem (Wilson, 1992, p. 255). This has caused an interest in the study of "biological diversity" or "biodiversity." Biodiversity is also concerned with the ecological interactions among these species and the physical environment of their ecosystem. Furthermore, biodiversity deals with the genetic variability of life which is necessary for life to survive change or adapt. Humanity co-evolved with the rest of life on this planet. Also, evidence from field studies indicates that reduction in biodiversity proportionally affects the quality of services provided by the ecosystem (Wilson, p. 341-348). Wilson continues by urging everyone to acquire the knowledge on which a wise policy of conservation and development can be based for centuries to come. It is imperative that the public be well educated about biodiversity as it affects the equilibrium of the ecosystem and the existence of *Homo sapiens*. One of the most prominent ways to reach the public on this controversial issue is through the elementary middle, and high school teachers. Hence, teachers need to have adequate and accurate knowledge of biodiversity.

The challenge given by Otto T. Solbrig (Environment June, 1991, p. 5, 16-20, 34-38)

in his article on the "Origin and Function of Biodiversity" paved the way for this investigation. Solbrig explained how people altered biodiversity. He questionned the estimated number of species in existence which was reported by biologists to be between three and eight million. Solbrig suggested that there could be more. In his opinion, the present day scientist possesses just a rudimentary knowledge of biodiversity. He also worried about the perception of scientists concerning how the diversity of genes, genotypes, species and communities influence the ecosystem. Solbrig urged scientists to be concerned about the equilibrium of the ecosystem because the system that is not in equilibrium develops a different behavior which could be strange or even mysterious. In Solbrig's view, the major causes of diversity are: new genotypes that are constantly evolving in the population through mutation, recombination of related genetic phenomenon, and the immigration of individual organisms.

Getting accurate knowledge of the function of the food web is necessary to understand the position *of Homo sapiens* in the ecosystem. The effect of toxic compounds discharged into the environment must not be ignored as well. The role which a species plays in its community must be acknowledged. In short, everybody must know about biodiversity and its importance in the ecosystem. This paper employs a test of teachers knowledge about biodiversity (Norman-Stevens Test) to test a group of K-12 teachers in Michigan.

There were no tests found in the literature that measured teachers' knowledge of biodiversity. Furthermore, there was no information available in the literature about what teachers know about biodiversity and how various demographic variable affect their knowledge in this area.

Purpose

The major objectives of this study were:

1. To develop and pilot a biodiversity test for teachers (subsequently called the Norman-Stevens Biodiversity Test)
2. to determine the biodiversity knowledge teachers currently have
3. to determine how selected teacher demographic factor relate to their responses on this biodiversity test

Hypothesis

The following hypotheses were tested regarding the demographic variables is this survey:

1. There will be no significant differences between the number of years of experience of K-12 teachers and their scores on the Norman-Stevens Biodiversity Test
2. There will be no significant differences between the age of teachers and their scores on the Norman-Stevens Biodiversity Test.
3. There will be no significant difference in the number of environmental science/environmental education courses taken and their scores on the Norman- Stevens Biodiversity Test.
4. There will be no significant differences between grade level taught and their scores on the Norman-Stevens Biodiversity Test.
5. There will be no significant differences between scores of elementary,

middle and high school teachers on the Norman-Stevens Biodiversity Test.

6. There will be no significant differences between science majors and non-science majors on their scores on the Norman-Stevens Biodiversity Test.

Instrument

This investigation used a survey instrument developed by John Norman, Wayne State University, and Suzanne Stevens, Eastern Michigan University. The questions were divided into two major parts: the biodiversity concepts and demographic variables. Some of the questions on biodiversity concepts were derived from Otto T. Solbrig's writings (1991). The forty true/false questions on biodiversity concepts were categorized into three levels, namely: species diversity, ecosystem diversity, and genetic/ molecular diversity.

Some basic definitions of concepts used in the survey are presented as follows. The basic unit of hereditary is called the gene and it contains a piece of DNA that codes for a particular trait. Ecosystem is a unit of the biosphere in which matter and energy are transferred as communities of organisms interact with their environment. A species is viewed as group of living things whose members resemble each other and possesses the ability to mate and produce fertile offspring. While speciation is the process that separates genetic variations into distinct species. Members of a like species that live in a particular location are called a population. A community contains different types of species that co-exist without sharing the same DNA or mutation. Different types of species are essential for the proper function of a community. Molecular genetics is the study of chemistry of gene.

Methodology

The participants in this study were 64 teachers coming from different communities in the State of Michigan. The test was administered at the beginning of an environmental the course held at Higgins Lake, Michigan. The first set of questions [1-40] addressed all the three levels of biodiversity as described by Solbrig. The second set of questions [41-61] were demographic, soliciting information on background and identity of the teachers. Respondents were to indicate their age, years of teaching experience, grade level taught, certification area, type of community in which they taught, subject taught, and the environmental science and/or environmental education courses taken.

The data analyses consisted of calculating the frequency of responses for each item, percentage of responses for each item, analysis of variance for each of the demographiuc variables, analysis of variance of scores of teacher knowledge on various subcategories of the Biodiversity Test, and internal inconsistency reliability coefficients for the entire test and for separate categories on the test.. The validity of Norman-Steven Biodiversity Test was determined by asking three environmental biologists to indicate whether the test questions/answers were accurate and also to evaluate the placement of the questions into the various biodiversity categories. The biologists agreed that the questions were accurate and that they were placed in an appropriate category.

The reliability analysis of the Norman-Steven Biodiversity Test was good, with an overall internal consistency reliability of r=.83, which implies that the survey instrument had a good reliabiltiy.. Subscale reliabilities for the species diversity level was r=.68, for

ecosystem level was r=.64, and for the genetic/ molecular level it was r=.37. The subscale reliabilities for the species and ecosystem levels was considered fair. However, for the genetic/molecular level reliability was poor and this was probably due to the fact that there were only seven items in this section. The species diversity level contained 20 items, the ecosystem level contained 13 items and the genetic/molecular level contained 7 items.

Results

The frequency of responses for the individual test items showed that teachers had some weaknesses and strengths in their knowledge of biodiversity. It was surprizing to see that only 25% of the teachers knew the definition of a community (item #31) and only 9% understood succession (item #16). On the other hand, about 98% of the teachers in the survey knew that species diversity was important for proper functioning of communities (item #20). Tables 1 and 2 contain the percentage and the number of teachers that answered each of the biodiversity questions correctly. Tables 3-9 show the one-way analysis of variance results for each of the demographic variables. There were no significant differences found in the teacher scores for each of these demographic variables at the alpha level of .05 except for the number of environmental science and environmental education courses taken (see tables 3a and 3b). Tables 10-12 present the means and one-way analysis of variance results for each the three test subcategories, namely the ecosystem, species diversity and genetic molecular levels.The results of this analysis demonstrated that there was not a significant difference ($p < .05$) in teachers' knowledge on the three subcategories.. Since the reliabilities for these subcateories of test questions are not strong, care must be taken in interpreting data

based on subcategory comparisons.

Table 1
Strength of Teachers' Knowledge About Biodiversity

Items form Norman-Stevens Biodiversity Test	Number of teachers answering question correctly	Percentage of teachers answering question correctly
Some species of organisms are always becoming extinct	59	92.2
Most tropical insects and soil oganisms have been identified	58	90.6
Most, if not all, ecosystems are not in balance	45	70.3
The availability of environmental resources (i.e. minerals, water, food) does not affect animal reproduction	63	98.4
The regular appearance of mutations give life its diversity	45	70.3
Natural selection favors individuals that are efficient in harvesting resources	56	87.5
Species diversity is important for proper functioning of communities	63	98.4
Food webs are essential for ecosystems	59	92.2
Species abundance changes with latitude	53	82.8
Decomposers are necessary for ecosystems to function properly	61	95.3
Response to a disturbance varies greatly from one ecosystem to another	49	77.8
A niche is the role in the environment that every species in a community occupies	53	82.8
Variability within a species is not important for long-term survival	53	82.8
A community is defined as all the populations of organisms living in an area	56	87.5
World population growth has not been related to diversity loss	53	82.8
Increasing world consumption of resources has been related to biodiversity loss	61	95 .3
Habitat destruction is the primary reason for modern day extinction of plants and animals	62	96.9
Coral reefs are as rich in biodiversity as tropical forests	50	82.8

Note: Teachers were said to be strong on a particular question if at least 70% or more answered the question correctly. There were 64 teachers in the survey.

Table 2
Weakness of Teachers' Knowledge About Biodiversity

Items from Norman-Stevens Biodiversity Test	Number of teachers answering question correctly	Percentage of teachers answering question correctly
The use of renewable resources often decreases species diversity	29	45.3
The oceans have more diversity of animals and plants than the tropical rain forests	37	57.8
Ecosystems, although not in balance now, are moving constantly toward equilibrium	29	45.3
New species are being formed each year in natural ecosystems.	36	56.3
There are about 300,000 species of organisms living today.	29	45.3
Given the appropriate environment and resources, different DNA molecules will reproduce at a variety of different rates.	14	21.9
Natural selection is a process that largely involves chance.	34	53.1
There is no way to predict what mutation is going to occur in a given situation.	30	46.9
A population of organisms can demonstrate succession under certain environmental conditions	6	9.4
Like reversible chemical reactions, changes in the DNA molecule within an organism can be reversed under certain conditions.	30	46.9
Natural selection is primarily responsible for the reduction of biodiversity	23	35.9
Simple ecosystems (with few species types) are more productive than complex ones.	17	26.6
Simple ecosystems are generally more stable than a complex ecosystem	32	50.0
Satellites can directly detect species diversity	42	65.6
Remote sensing technology can directly detect species diversity.	28	43.8

The variety of apple tree species today is greater than in the early 1900's.	16	25.0
Commercial exploration of organisms (i.e. fur, pets, medicine) is not the major reason for the loss of biodiversity.	28	43.0
There is less diversity today than at the turn of century.	26	40.6

Note: Teachers were said to be weak on a particular question if less than 70% of the respondents answered that question correctly. This group of questions indicated the areas teachers needed to improve on in their knowledge of biodiversity

Table 3a
Mean Scores of Teachers on the Norman-Stevens Biodiversity Test for the Number of Environmental Science/Environmental Education Courses Taken

Group	Frequency	Mean	SD
Teachers who had no environmental science/ environmental education course	21	22.43	2.73
Teachers who had 1-2 environmental science/ environmental education course(s)	17	22.82	2.46
Teachers who had 3 or more environmental science/environmental education courses	17	25.71	1.78

Table 3b
One-way Analysis of Variance of Teacher Scores on the Norman-Stevens Biodiversity Test by Number of Environmental Science/Environmental Education Courses Taken

Source	df	Sum of Sq	Mean Sq	F Ratio	F Prob
Between Groups	2	58.60	29.30	4.64	0.015*
Within Groups	42	265.04	6.31		
Total	44	323.64			

*significant at $p < .05$

Table 4a
Mean Scores of Teachers on the Norman-Stevens Biodiversity Test or the Type of Community Where Teachers Taught

Type of Community	Frequency	Mean	SD
Rural or small town	19	23.47	2.45
Suburban community	17	22.23	2.68
Urban community	9	23.89	3.14

Table 4b
One-way Analysis of Variance of Teacher Scores on the Norman-Stevens Biodiversity Test by Type of Community Where Teachers Taught

Source	df	Sum of Sq	Mean Sq	F Ratio	F Prob
Between Groups	2	20.96	10.48	1.45	0.24
Within Groups	42	302.68	7.21		
Total	44	323.64	11.49		

Note: The difference between the mean score of teachers that teach in various types of communities was not statistically significant at the .05 level.

Table 5a
Mean Teacher Scores on the Norman-Stevens Biodiversity Test by School Level

School Level	Frequency	Mean Score	SD
Elementary school teachers	27	23.50	4.65
Middle school teachers	24	23.30	3.12
High school teachers	13	22.60	2.53

Table 5b
One-way Analysis of Variance of Teacher Scores on the Norman-Stevens Biodiversity Test by School Level

Source	df	Sum of Sq	Mean Sq	F Ratio	F Prob
Between Groups	2	4.36	2.16	0.24	0.79
Within Groups	25	231.60	9.30		
Total	27	236.96			

Note: The mean scores for school level was not significantly significant at the .05 alpha level

Table 6a
Mean Scores of Teachers on the Norman-Stevens Biodiversity Test by Amount of Instruction about Biodiversity

Amount of instruction about biodiversity	Frequency	Mean	STD
Teachers who have introduced concept of biodiversity to their students	17	23.73	2.88
Teachers who have not introduced concept of biodiversity to their students	47	22.47	7.52

Table 6b
One-way Analysis of Variance of Mean Teacher Scores on the Norman-Stevens Biodiversity Test by Amount of Biodiversity Instruction

Source	df	Sum of Sq	Mean Sq	F Ratio	F Prob
Between Groups	2	4.36	2.18	.24	.79
Within Groups	25	232.60	9.30		
Total	27	236.96			

Note: There was no significant difference found at the alpha level of .05 between the mean scores of teachers who introduced the concept of biodiversity to their students and those that did not.

Table 7a
Mean Scores of Teachers on the Norman-Stevens Biodiversity Test for Teachers Certified in Science and Non-Science Certified Teachers

Certification	Frequency	Mean	STD
Teachers certified in science	45	23.50	5.86
Teachers not certified in science	19	22.00	3.97

Table 7b
One-way Analysis of Variance of Mean Teacher Scores on the Norman-Stevens Biodiversity Test by Certification Area

Source	df	Sum of Sq	Mean Sq	F Ratio	F Prob
Between Groups	1	20.41	20.41	2.78	.10
Within Groups	41	301.50	7.35		
Total	42	321.91			

Note: There was no significant difference found at the alpha level .05 between teachers certified in science and those that were not.

Table 8a
Mean Scores of Teachers on the Norman-Stevens Biodiversity Test for teachers at Different Age Levels

Teacher Age Level	Frequency	Mean	STD
20-30 years old	27	23.16	4.58
31-41 years old	17	22.59	2.83
> 41 years old	20	23.89	2.97

Table 8b
One-way Analysis of Variance of Mean Teacher Scores on the Norman-Stevens Biodiversity Test by Age of Teacher

Source	df	Sum of Sq	Mean Sq	F Ratio	F Prob
Between Groups	2	19.26	9.53	1.33	.28
Within Groups	42	304.39	7.25		
Total	44	323.64			

Note: There was no significant differences found in the mean scores of teachers of varying age levels at the .05 alpha level.

Table 9a
Mean Scores of Teachers on the Norman-Stevens Biodiversity Test for Differering Amounts of Teaching Experience

Amount of Teaching Experience	Frequency	Mean	STD
No teaching experience	26	23.16	3.46
1-10 years teaching experience	25	22.59	2.78
>10 years teaching experience	13	23.89	1.89

Table 9b
One-way Analysis of Variance of Teacher Scores on the Norman-Stevens Biodiversity Test by Years of Teaching Experience

Source	df	Sum of Sq	Mean Sq	F Ratio	F Prob
Between Groups	2	10.11	5.06	.68	.513
Within Groups	42	313.53	7.47		
Total	44	323.64			

Note: There was no significant difference found at the alpha level .05 between the mean scores of teachers with different amounts of teaching experience

Table 10
Mean Scores of Teachers on the Species Subgroup of Questions of the Norman-Stevens Biodiversity Test for Teachers at Various Grade Levels

Teacher Grade Level	Frequency	Mean	STD
Elementary	27	9.17	0.94
Middle School	24	8.29	0.73
High School	13	8.33	0.58
Total Teachers	64	8.51	0.75

Note: The highest possible correct score in this species subgroup was 19. The mean correct scores of teachers in each of these grade levels was less than 70% of the possible correct total score. There was no significant difference found in a one-way analysis of variance of the mean scores for teacher grade levels at the alpha level .05.

Table 11
Mean Scores of Teachers on the Ecosystem Subgroup of Questions of the Norman-Stevens Biodiversity Test for Teachers at Various Grade Levels

Teacher Grade Level	Frequency	Mean	STD
Elementary	27	6.84	2.06
Middle School	24	7.00	2.33
High School	13	6.80	1.79
Total Teachers	64	6.90	2.10

Note: The highest possible correct score in this ecosystem subgroup was 14. The mean correct scores of teachers in each of these grade levels was only about 50% of the correct answers. There was no significant difference found in a one-way analysis of variance of the mean scores for teacher grade levels at the alpha level .05

Table 12
Mean Scores of Teachers on the Genetic Molecular Level Subgroup of Questions of the Norman-Stevens Biodiversity Test for Teachers of Various Grade Levels

Teacher Grade Level	Frequency	Mean	STD
Elementary	27	3.95	1.51
Middle School	24	3.81	1.28
High School	13	3.60	0.89
Total Teachers	64	3.85	1.33

Note: The highest possible correct score in this genetic molecular question subgroup was seven. The mean correct scores of teachers in each of these grade levels was less than 70% of the correct answers. There was no significant difference found in a one-way analysis of variance of the mean scores for teacher grade levels at the alpha level .05.

Conclusions and Recommendations

The Norman-Stevens Biodiversity Test was found to be a valid and reliable test. Care must be taken in interpreting the subtest scores since these reliabilites were not strong.

Teacher knowledge about biodiversity is fairly limited as measured by their average scores on the entire test which was about 50% (n=64).

The demographic variables of type of community, school level taught, amount of student instruction about biodiversity, teacher certification area, age of teacher, and years of teaching experience did not significantly ($p<.05$) affect the teachers scores on the Biodiversity Test. However, the demographic variable of the number of environmental science and/or environmental education courses taken did significantly ($p<.05$) affect the teacher scores on this test. Scores were higher for teachers who had taken more courses in environmental science and/or environmental education. There were no significant differences ($p<.05$) found between the teachers scores on the various subgroup categories of the Biodiversity Test.

An important implication that might be drawn from this study is that K-12 teachers need to know more about biodiversity. Furthermore, this study suggests that more environmental science and/or environmental education courses should be be taken at the college or university levels to help to improve teacher knowledge about biodiversity. If teacher knowledge about biodiversity is related to their student's knowledge about biodiversity, then it would be important to upgrade teacher knowledge in this area. Consideration might be given to requiring all teachers to take environmental science and environmental education courses as part of their certification program.

More questions might be added to each of the subcategories of questions on the Test so that higher subtest reliabilites can be obtained. This would be useful for analysis and comparison of groups on these subscales.

Consideration should be given to establishing national norms for this test so that various schools and parts of the country could compare their results. Also, a confirmatory factor analysis might be done on this test which requires a much larger sample that was used in this study.

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Appendix

NORMAN-STEVENS BIODIVERSITY TEST

Name_____

Directions: True or False

T F 1. The use of renewable resources often decreases species diversity.

T F 2. The oceans have lesser diversity of animals and plants than the tropical rain forests.

T F 3. Some species of organisms are always becoming extinct.

T F 4. Ecosystems, although not in balance now, are moving constantly toward equilibrium.

T F 5. Most tropical insects and soil organisms have been identified.

T F 6. Most, if not all, ecosystems are not in balance.

T F 7. When land used for agriculture in the Amazon Forest is abandoned, it will return to the original forest.

T F 8. New species are being formed each year in natural ecosystems.

T F 9. There are about 300,000 species of organisms living today.

T F 10. The availability of environmental resources (i.e. minerals, water, and food) does not affect animal reproduction.

T F 11. The regular appearance of mutations gives life its diversity.

T F 12. Given the appropriate environment and resources, different DNA molecules will reproduce at a variety of different rates.

T F 13. Natural selection is a process that largely involves chance.

T F 14. There is no way to predict what mutation is going to occur in a given situation.

T F 15. Natural selection favors individuals that are efficient in harvesting resources.

T F 16. A population of organisms can demonstrate succession under certain environmental conditions.

T F 17. Like reversible chemical reactions, changes in the DNA molecule within an organism can be reversed under certain conditions.

T F 18. Natural selection is primarily responsible for the reduction of biodiversity.

T F 19. Hunting is primarily responsible for the reduction of biodiversity of mammals.

T F 20. Species diversity is important for proper functioning of communities.

T F 21. Simple ecosystems (with few species types) are more productive than complex ones.

T F 22. Simple ecosystems are generally more stable than complex ones.

T F 23. Food webs are essential for ecosystems.

T F 24. Species abundance changes with latitude.

T F 25. Response to a disturbance varies greatly from one ecosystem to another.

T F 26. Satellites can directly detect species diversity.

T F 27. Remote sensing technology can directly detect species diversity.

T F 28. Decomposers are necessary for ecosystems to function properly.

T F 29. A niche is the role in the environment that every species in a community occupies.

T F 30. Variability within a species is not important for long-term survival.

T F 31. A community is defined as a large number of a particular species of organisms living in an area.

T F 32. Plants are necessary for most ecosystems to function properly.

T F 33. Commercial exploitation of organisms (i.e. fur, exotic pets, medicines) is thought to be the major reason for the loss of biodiversity.

T F 34. There is a greater diversity of agricultural species today than at the turn of the century.

T F 35. World population growth has not been related to biodiversity loss.

T F 36. Increasing world consumption of resources has been related to biodiversity loss.

T F 37. Habitat destruction is the primary reason for modern day extinction of plants and animals.

T F 38. The varieties of apple tree species today is greater than in the early 1900's.

T F 39. Coral reefs are as rich in biodiversity as tropical forests.

T F 40. Once a species becomes endangered, it will eventually become extinct.

PERSONAL INFORMATION (DEMOGRAPHIC)

41. Which environmental organizations do you belong (circle the letters of all that apply)
   a. Michigan Association for Environmental and Outdoor Education
   b. Michigan United Conservation Clubs
   c. National Audubon Society
   d. Nature Conservancy
   e. National Wildlife
   f. Sierra Club
   g. Other (please specify) _____
   h. Other (please specify) _____
   I. Other (please specify) _____

42. How many environmental science (or ecology) and/or environmental education courses have you taken prior to this one?
a. None b. 1 - 2 c. 3 or more

43. Which environmental programs in the television do you regularly watch (circle all that apply)?
a. NOVA b. Discovery
c. Other (please specify) 1. _____
2. _____
3. _____

44. How many years of teaching experience do you have?
a. None (Circle one: pre-service teacher, DNR staff, or other)
b. 1 - 10 years
c. greater than 10 years

[Note: If you are not a teacher, then skip to question #50)

45. Which of the following best describes the community in which you teach
a. Rural or small town
b. Suburban
c. Urban

46. What student grade level are you mainly responsible for?
a. Elementary b. Middle School
c. High School d. Other(please specify)

47. Have you introduced the concept of biodiversity to your students?
No _____ Yes _____

48. Which environmental units have you taught in the last year?
a. Whales b. Tropical Rain Forest c. Insect Ecology
d. Water Ecology e. Toxic Wastes f. Recycling g. Acid Rain
h. Plant Ecology I. Energy
j. Air Pollution k. Other (please specify) _____

49. What subject majors are you certified (or preparing to be certified) to teach?
a. Science
b. Other (please specify) _____

50. What age range do you fall within?
a. 20-30 b. 31-41

51. Which environmental projects in your community (or school) have you actively participated in the past five years (circle all that apply)?
a. None b. River cleanup c. Recycling
d. Monitoring Wildlife (i.e. bird counts) e. Toxic Waste Clean Up
f. Other (please specify) _____

52. How many environmental science (or ecology) and/or environmental education course have you taken prior to this one?
a. None
b. 1 -2
c. 3 or more

53. Which environmental programs in the television do you regularly watch (circle all that apply)?
a. NOVA
b. Discovery
c. Other (please specify) 1. _____
2. _____
3. _____

54. How many years of teaching experience do you have?
a. None (Circle one: pre-service teacher, DNR staff, or other)
b. 1 - 10 years
c. greater than 10 years

[Note: If you are not a teacher, then skip to question #60]

55. Which of the following best describes the community in which you teach
a. Rural or small town
b. Suburban
c. Urban

56. What student grade level are you mainly responsible for?
a. Elementary
b. Middle School
c. High School
d. Other (please specify) _____

57. Have you introduced the concept of biodiversity to your students?
No _____
Yes _____

58. Which environmental units have you taught in the last year? (Circle all that apply)
a. Whales
b. Tropical Rain Forest
c. Insect Ecology
d. Water Ecology
e. Toxic Wastes
f. Recycling
g. Acid Rain
h. Plant Ecology
i. Energy
j. Air Pollution
k. Other (please specify) _____

59. What subject majors are you certified (or preparing to be certified) to teach?
a. Science
b. Other (please specify) _____

60. What age range do you fall within?
a. 20 - 30
b. 31 - 41
c. 42 or over

61. Which environmental projects in your community (or school) have you actively participated in the past five years (circle all that apply)?
a. None
b. River Clean Up
c. Recycling
d. Monitoring Wildlife (i.e. bird counts)
e. Toxic Waste Clean Up
f. Other (please specify) _____